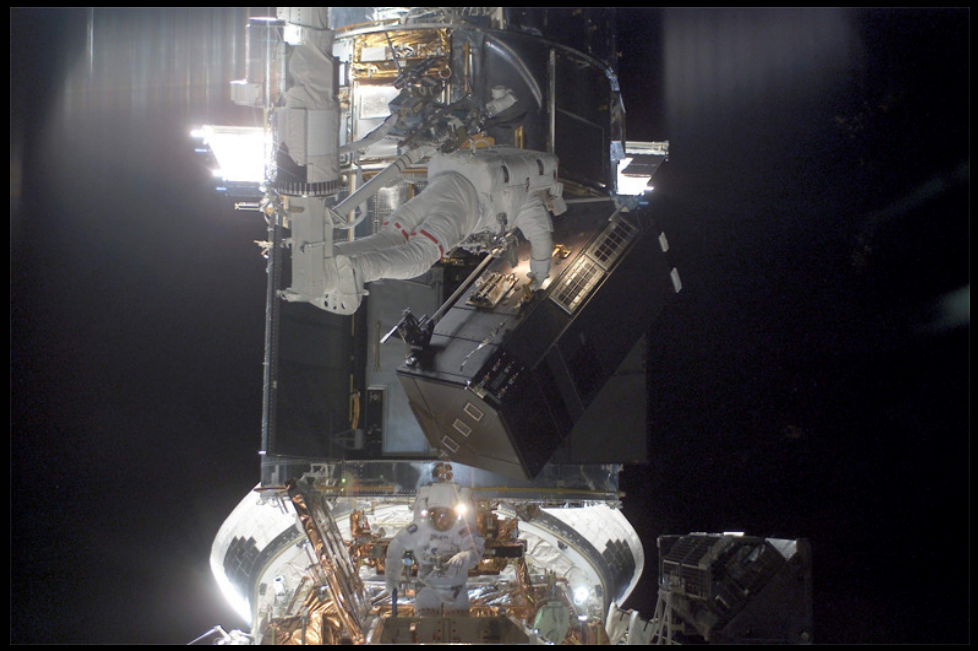
Hubble Space Telescope

Dr. Alan Stern

NASA Headquarters,
Associate Administrator,
Science Mission Directorate

January 8, 2008


NASA



Hubble Servicing Mission 4

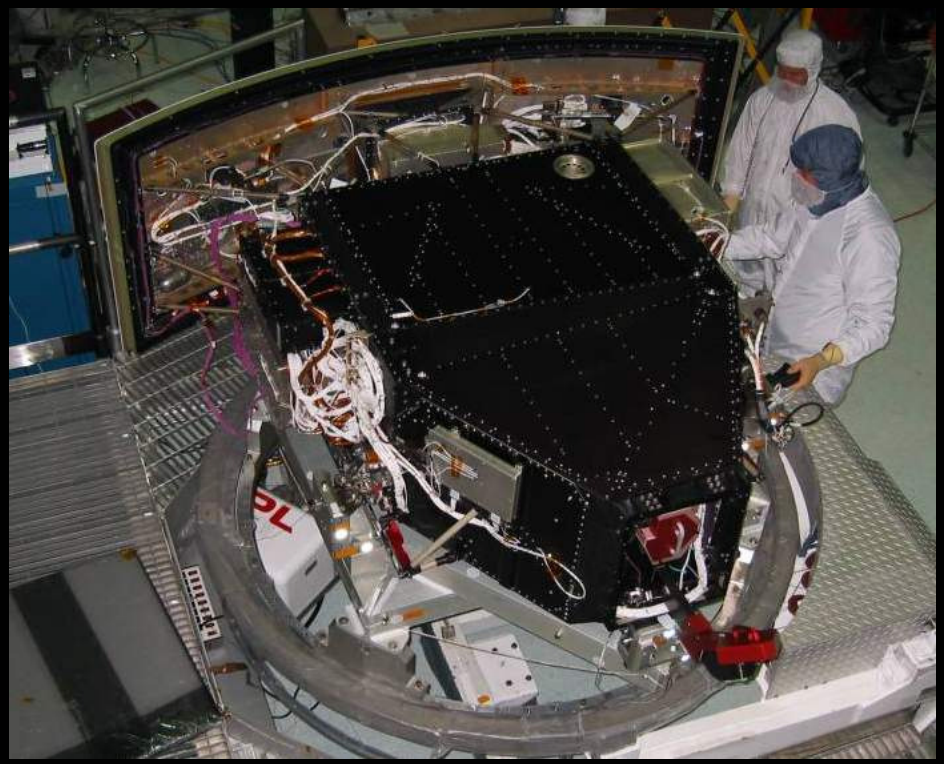
David Leckrone
HST Senior Project Scientist
January 8, 2008

SM4 Mission Overview

- WFC3
- COS
- ACS Repair
- STIS Repair

- Gyroscopes
- Batteries
- FGS
- NOBL's
- Soft Capture Mechanism

WFC3 will be *the first Hubble wide-field camera spanning Ultraviolet – Visible - Infrared*

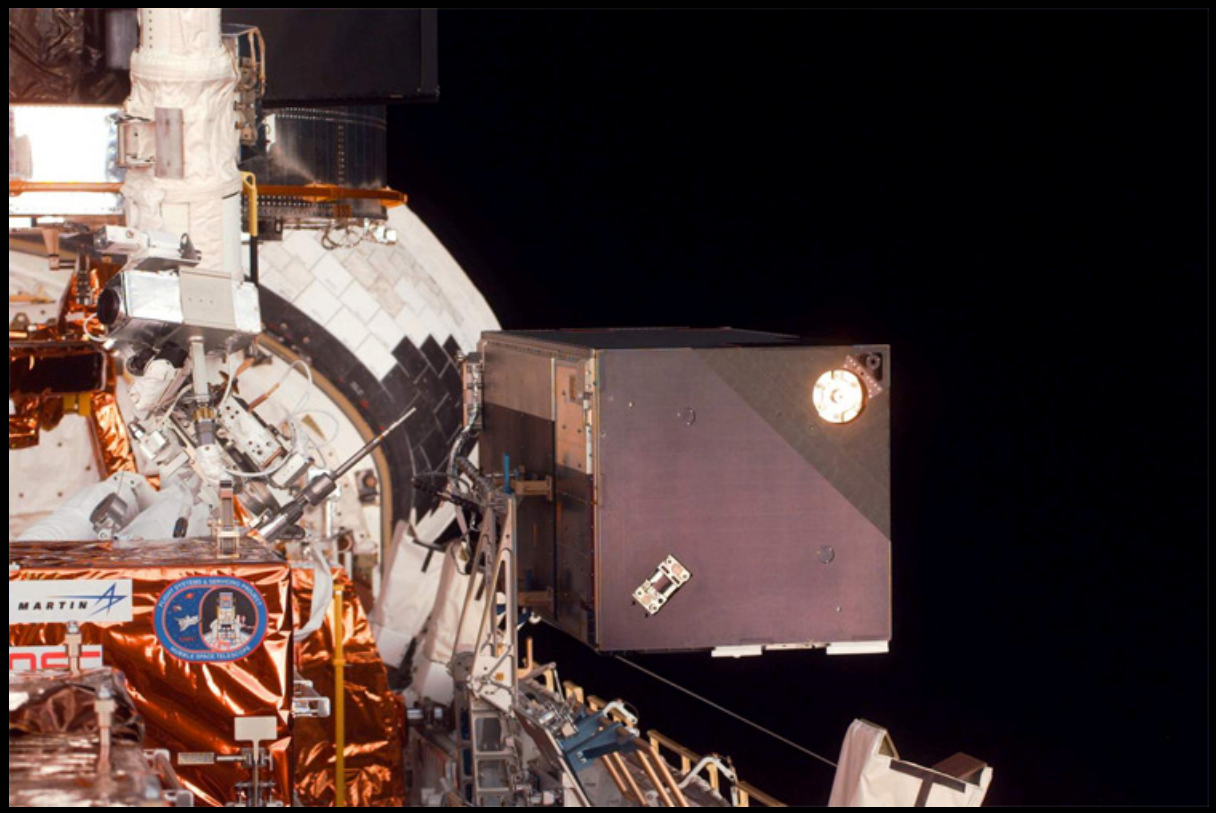


- Wide Field Camera 3 provides wide-field, high sensitivity, high resolution, wide dynamic range, extensive filter set from 200 nm – 1700 nm
  - UVIS channel has > 30x discovery power of ACS in the Ultraviolet
  - IR channel has ~25x discovery power of NICMOS in the Infrared
  - Complements high discovery efficiency of ACS at Visible – Red wavelengths

COS will be *the most sensitive UV spectrograph ever to fly on Hubble*

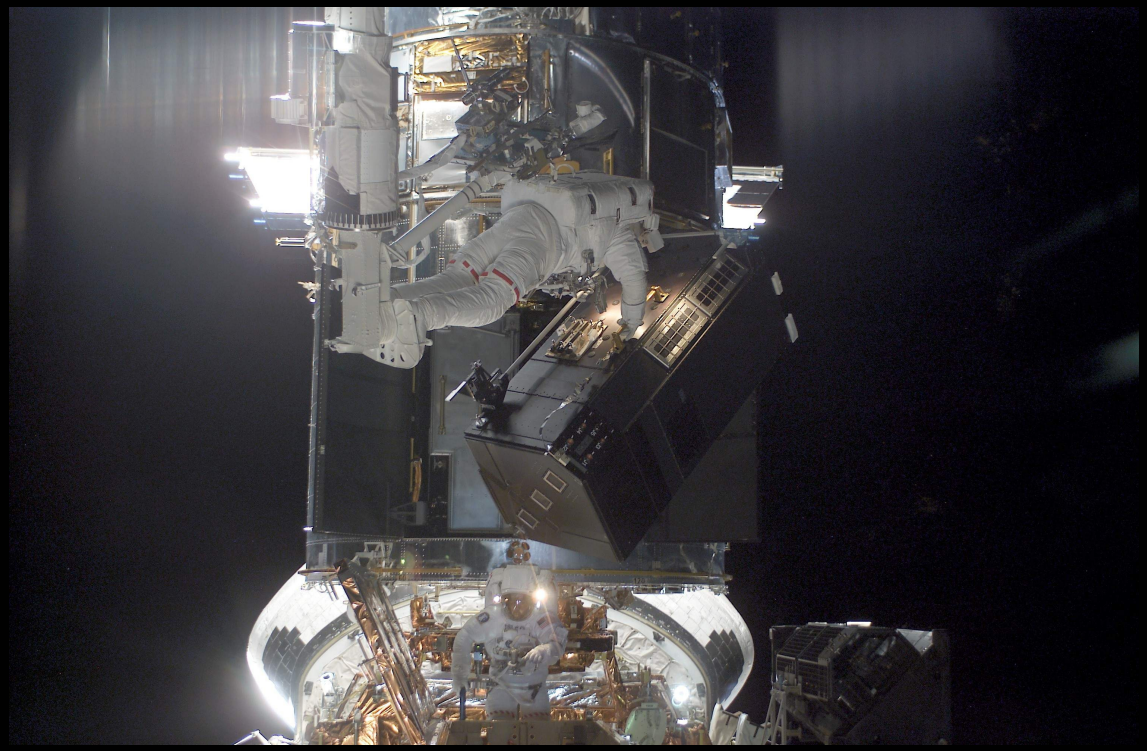
- COS is designed to observe point sources (stars, quasars)
- Far-UV channel is up to 70x faster than STIS at wavelengths 115 - 200 nm
- Near-UV channel is ~ 5x faster than STIS at wavelengths 200 – 300 nm
- Both channels provide low and moderate spectral resolution

STIS is *the most versatile spectrograph ever to fly in space*



- STIS is a two-dimensional imaging spectrograph ideal for observing extended objects
- STIS provides both UV- and Visible-light spectroscopy
- STIS provides very high resolution spectroscopy
- STIS + COS bring the full set of spectroscopic tools required for astrophysics to HST

ACS Is *Hubble's Most Powerful Visible-Light Camera*



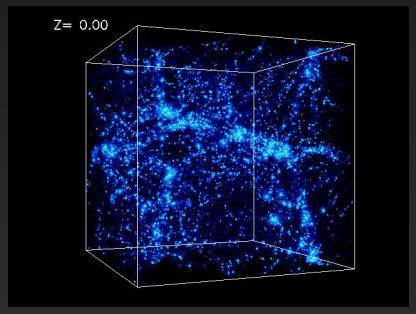
- Wide Field Channel is optimized for deep surveys of the sky from 500 to 1000 nm
- High Resolution Channel contains Hubble's best coronagraph
- Solar Blind Channel allows high resolution imagery at wavelengths < 180 nm
- ACS was the most heavily used Hubble instrument at the time of its failure

MISSION GOAL: ***When the astronauts leave Hubble for the last time, it will be at the apex of its capabilities - better than it has ever been before.***

WFC3 + ACS + NICMOS = Most powerful imaging ever

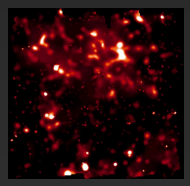
COS + STIS = Full set of tools for astrophysics

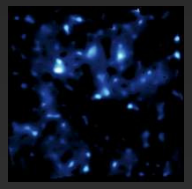
The architecture of the universe



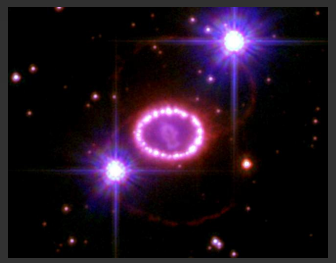
The life story of galaxies

The mysteries of dark matter and dark energy

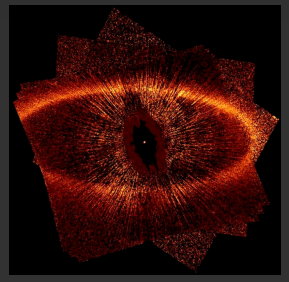


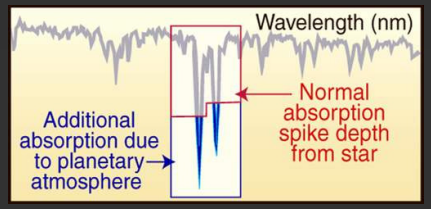


The birth and death of stars



Recipes for building planets

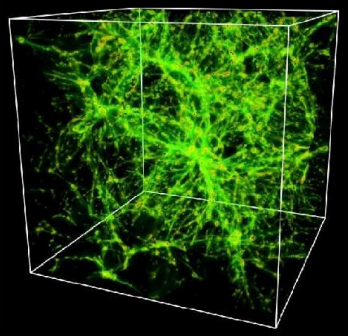




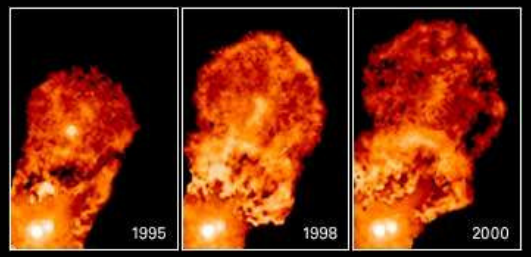
Backup

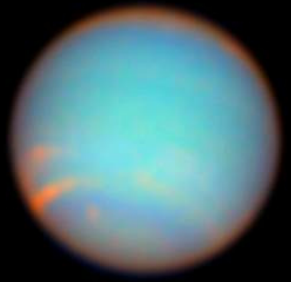
COS will study:

- **Large-scale structure by tracing Hydrogen Lyman-α absorptions**
- **Formation of galaxies**
- **Chemical evolution of galaxies and the intergalactic medium**
- **Hot stars and the interstellar medium of the Milky Way**
- **Supernovae, supernova remnants and the origin of the elements**
- **Young Stellar Objects and the formation of stars and planets**
- **Planetary atmospheres in the Solar System**



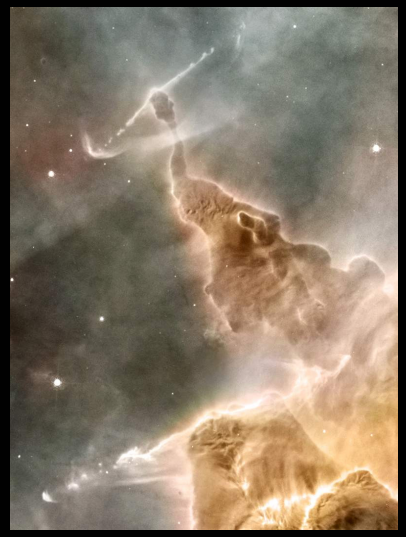


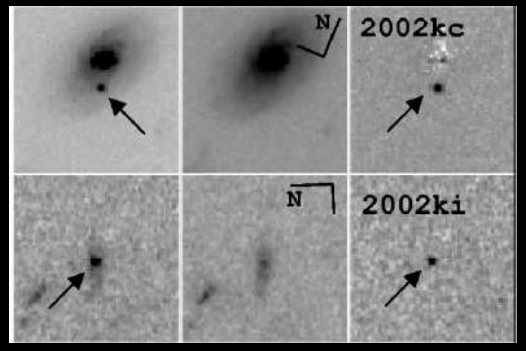





WFC3 Will Study:

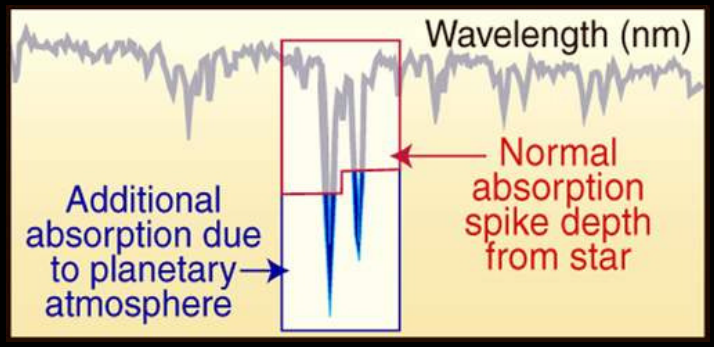
- The fossil record of star population history and evolution of nearby galaxies
- How the process of star formation and evolution has varied over cosmic time, among galaxies of various kinds
- The course of galaxy evolution over 13 billion years
- Infrared ultra-deep fields to provide a path-finding census of the Universe when it was < 1 billion years old
- The strength and variability with time of dark energy

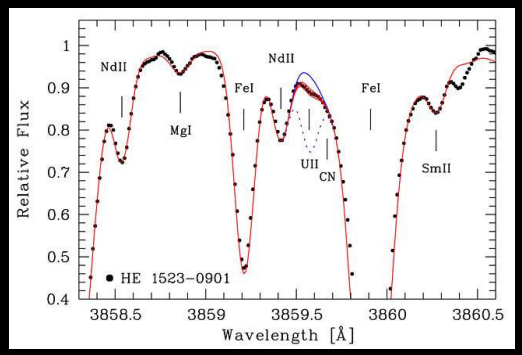


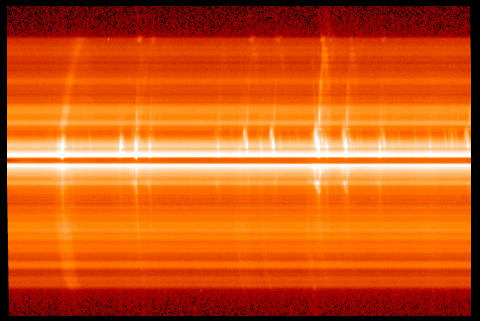


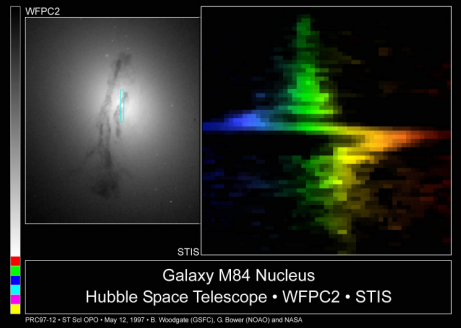
STIS studies:

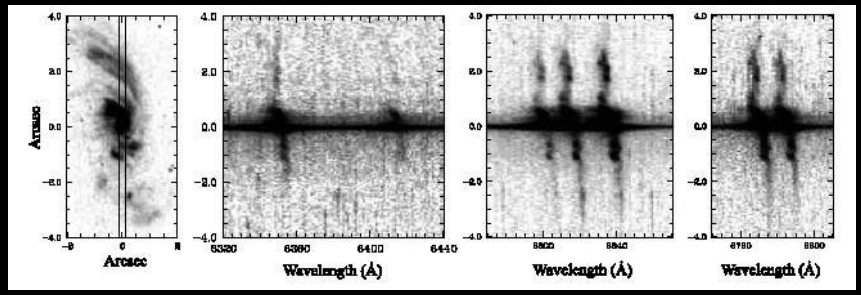
- The chemical composition of the atmospheres of extra-solar planets
- The chemical composition and other properties of stars and interstellar gas in the Milky Way galaxy
- The death throes of a dying, massive star, η Car; a future supernova close to Earth
- Supermassive black holes at the centers of galaxies and their relationship to galaxy structure and evolution
- Properties of active galactic nuclei





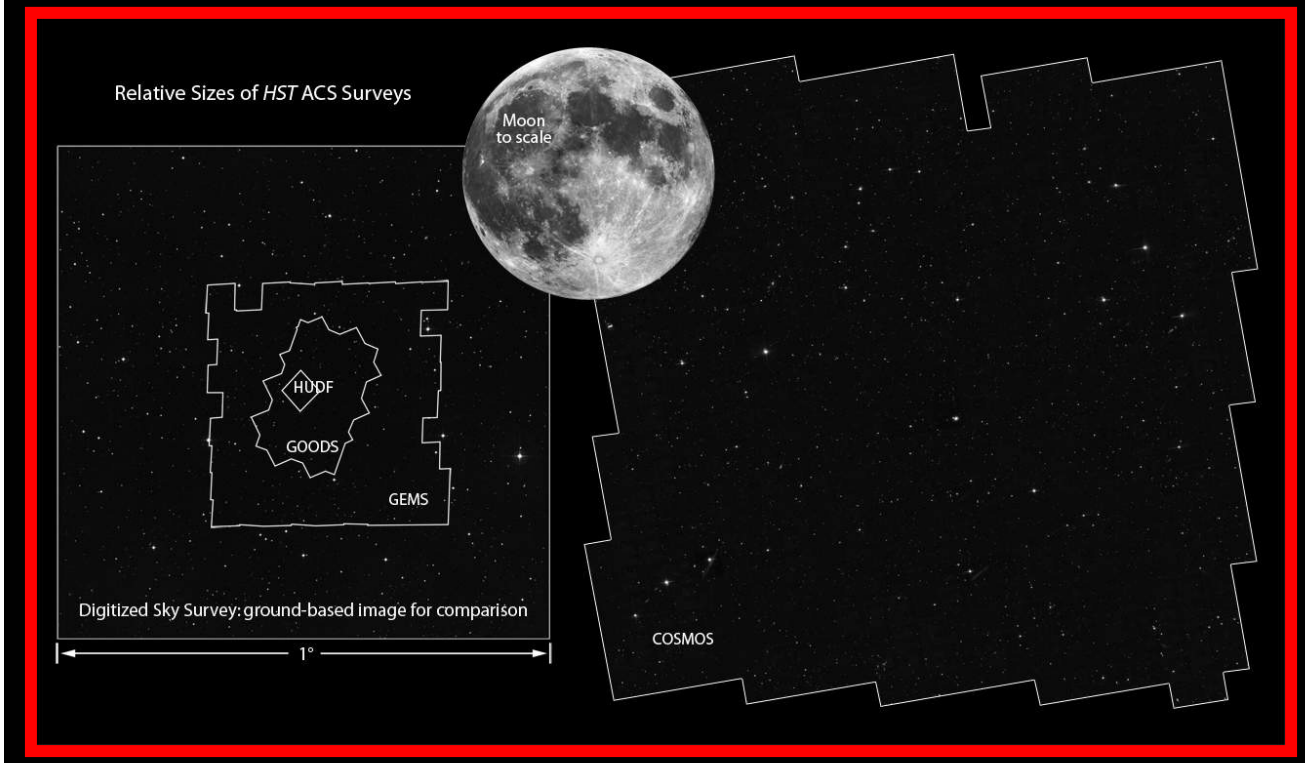


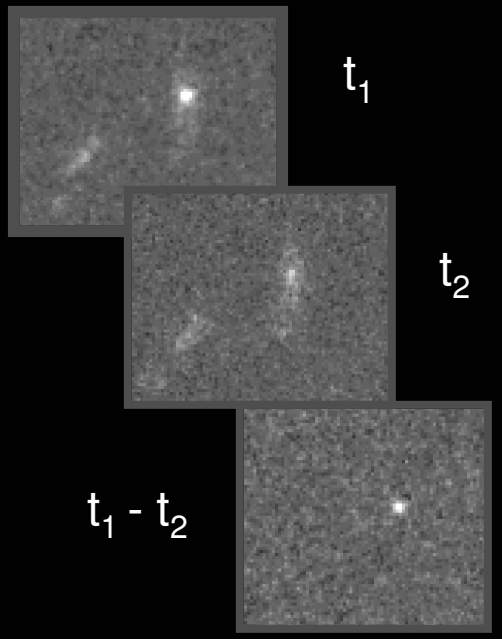




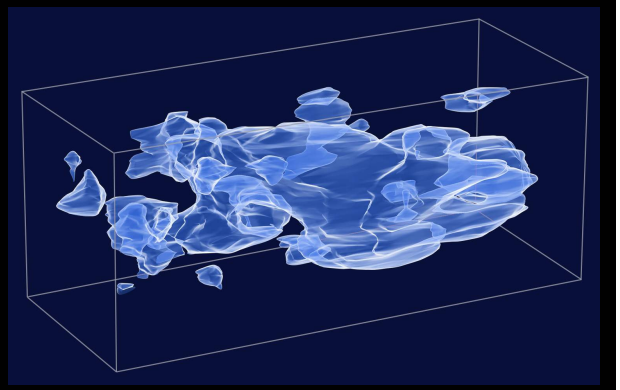
Critical Science Re-enabled by ACS Repair

- **Large sample of Type Ia Supernovae to improve measurements of strength and variability of dark energy**
- **Weak gravitational lensing surveys over very wide fields for 3-D mapping of dark matter**





Supernova Detection



3-D dark matter map

Hubble Space Telescope

STS-125 Mission Overview

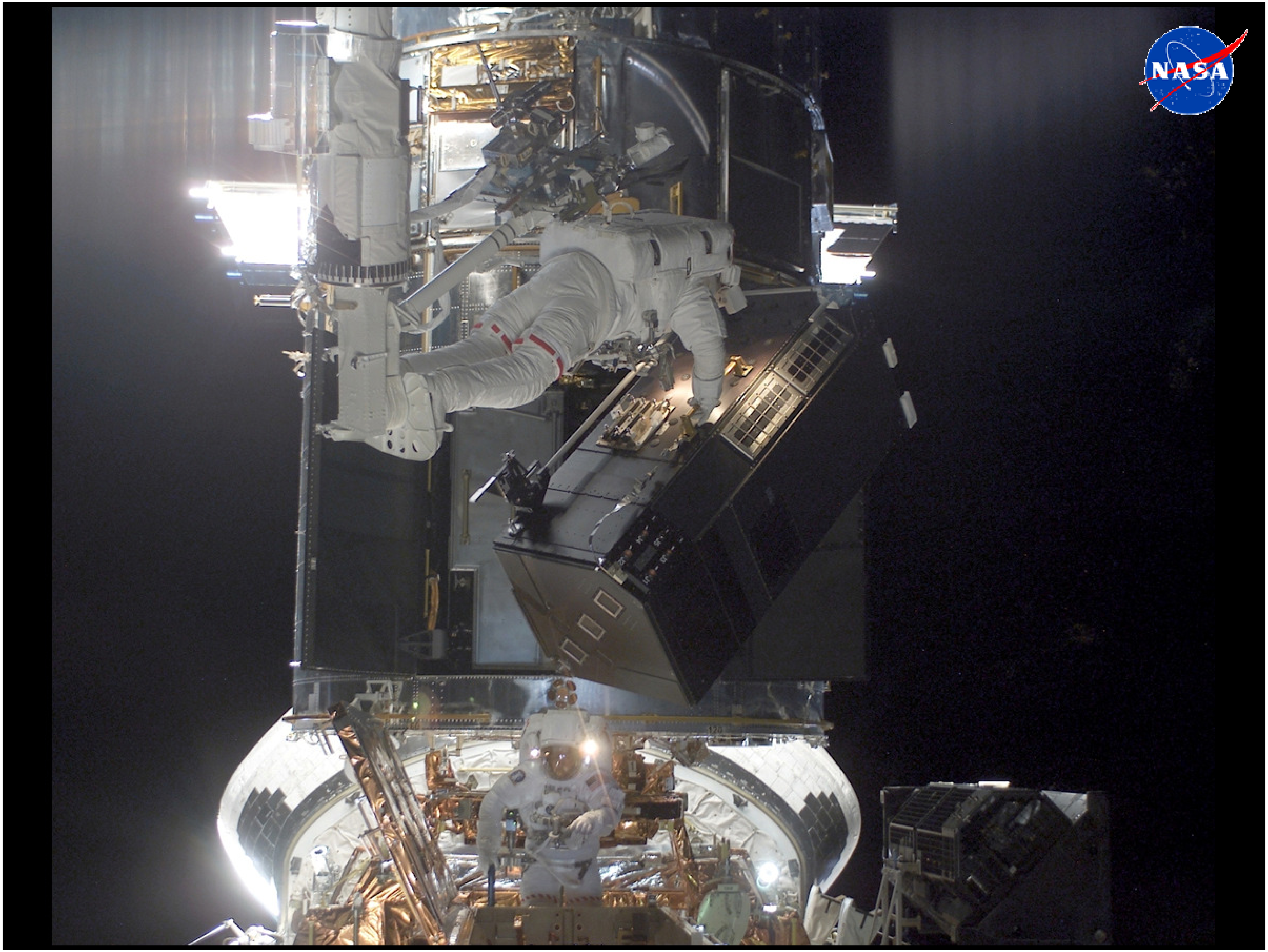
John Grunsfeld

NASA Astronaut
STS-125

January 8, 2008


STS-125 Crew
ALTMAN • JOHNSON • GRUNSFELD • MASSIMINO • FEUSTEL • McARTHUR • GOOD
125
HST
HUBBLE SPACE TELESCOPE
Servicing Mission
4
NASA


NASA
NASA
GODDARD SPACE FLIGHT CENTER



EVA Timeline

EVA 1	Initial Setup	WFC-3	Battery SCM	Close-out
EVA 2	Setup	Gyroscopes (RSU)	Battery SCM	Close-out
EVA 3	Setup	COS	ACS Part-1	Close-out
EVA 4	Setup	STIS	NOBL	Close-out
EVA 5	Setup	FGS	ACS Part-2	Final Closeout

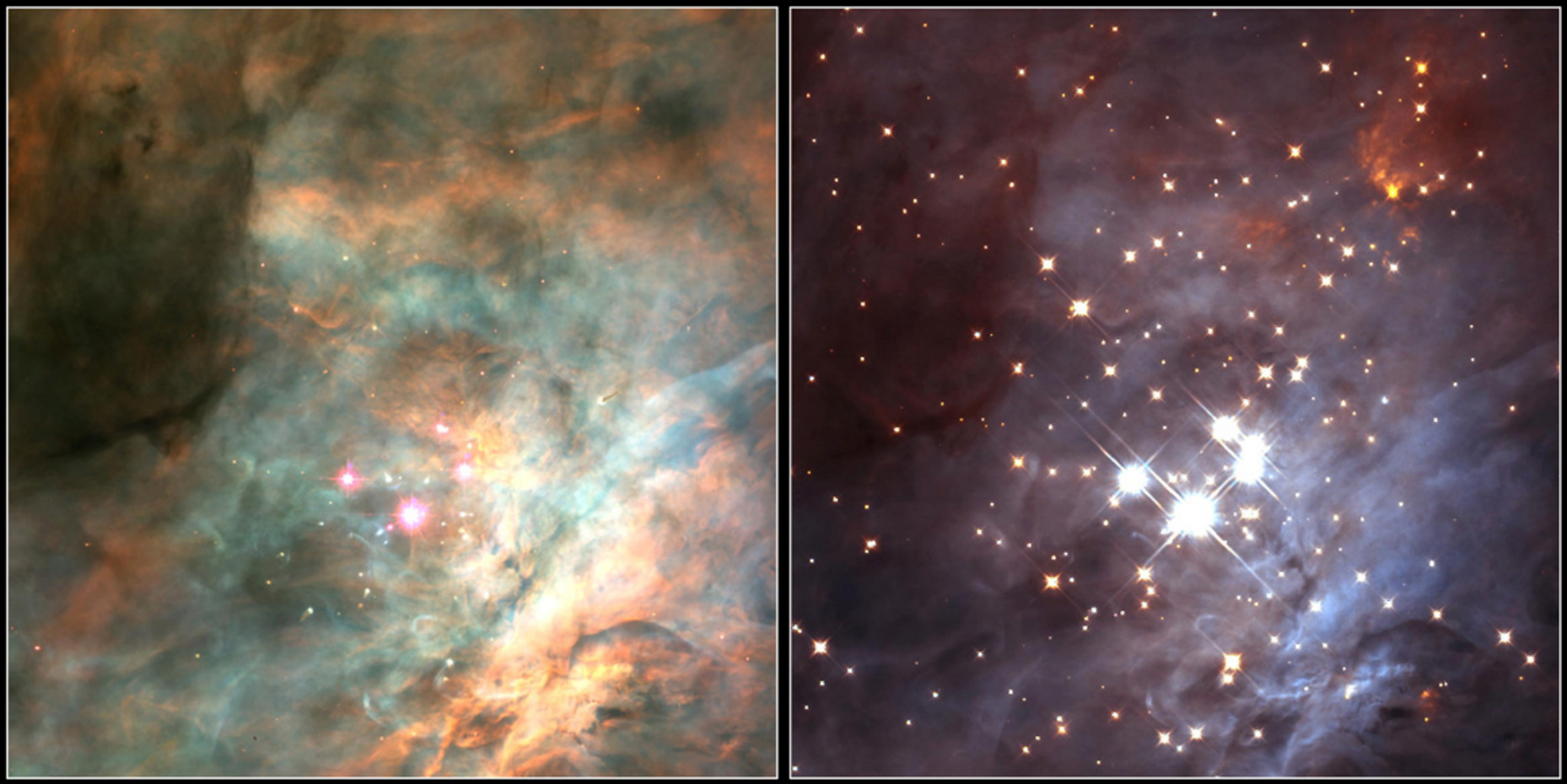
6 hours 30 minutes

Hubble Space Telescope

Science Highlights for a Refurbished Hubble

Sandra Faber
University Professor of
Astronomy & Astrophysics, U.C.
Santa Cruz

January 8, 2008



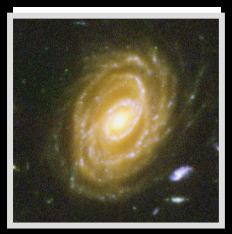
Trapezium Cluster • Orion Nebula

WFPC2 • **Hubble Space Telescope** • NICMOS

NASA and K. Luhman (Harvard-Smithsonian Center for Astrophysics) • STScI-PRC00-19

Hubble Ultradeep Field

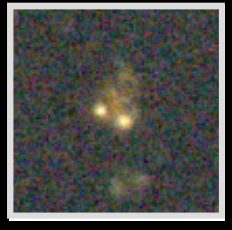
Age of universe now = 13.7 Gyr



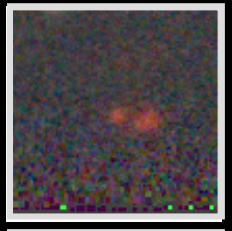
8.8 Gyr

3.3

2.2



1.8



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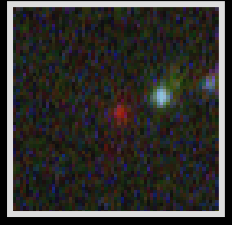

0.8

The **Cosmic Web** of Dark Matter in the Universe